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Misumi et al.

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(54) **SUCTION TOOL FOR VACUUM CLEANER**

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(51) **Int. Cl.**

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A46B 13/00	(2006.01)
A46B 13/02	(2006.01)
A46B 17/06	(2006.01)

(52) **U.S. Cl.**

CPC ***A47L 9/04*** (2013.01); ***A46B 13/006*** (2013.01); ***A46B 13/02*** (2013.01); ***A46B 17/06*** (2013.01); ***A47L 9/0455*** (2013.01)

(58) **Field of Classification Search**

CPC A47L 9/0477; A47L 9/0411; A47L 5/30; A47L 9/04; A47L 5/34; A47L 9/02
USPC 15/381, 382, 383, 384, 386, 390, 392, 15/48
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,863,285	A *	2/1975	Hukuba	15/48
2004/0117942	A1 *	6/2004	Roney	15/390

FOREIGN PATENT DOCUMENTS

JP	U-62-116918	7/1987
JP	A-62-217930	9/1987

(Continued)

OTHER PUBLICATIONS

Office Action dated Jul. 30, 2014 issued in corresponding CN patent application No. 201180016287.1 (and partial English translation).

(Continued)

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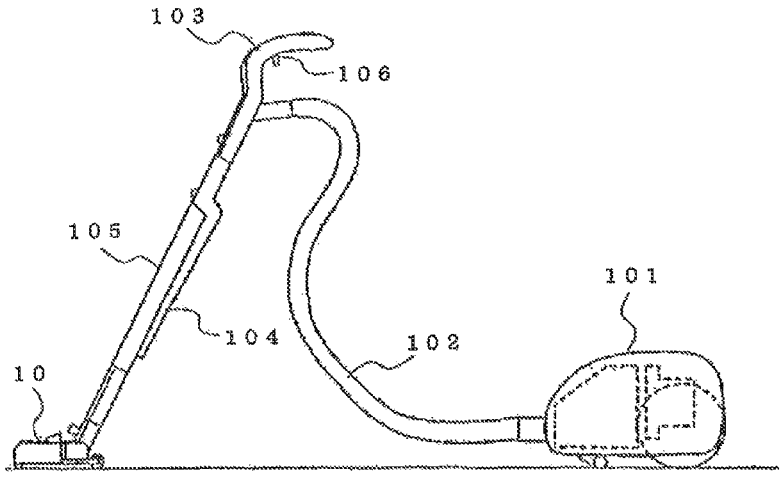
(57) **ABSTRACT**

There is provided a suction tool for a vacuum cleaner that can easily remove dust entangled around a rotating brush with a small force in a sanitary manner with clean hands without spreading dust.

The suction tool includes dust removing means **39** for removing dust adhering to a rotating brush **30**, the dust removing means **39** includes a first remover that has substantially the same shape as a trough **34** between cleaning bodies **33** or between cleaning body holding portions **32** of the rotating brush **30**, and is guided in an axial direction of the rotating brush **30** within the trough **34**.

17 Claims, 7 Drawing Sheets



(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP	A-2004-135809	5/2004
JP	A-2008-259718	10/2008

OTHER PUBLICATIONS

International Preliminary Report on Patentability dated Oct. 23, 2012, and the Written Opinion of the International Searching Authority dated Jul. 26, 2011 of PCT/JP2011/0057548 (and English translation).

Office Action dated Apr. 26, 2013 in the corresponding Taiwanese patent application No. 10220531280 (partial English translation).

JP Office Action dated Feb. 7, 2012 in priority JP Patent Application No. 2010-081593 of PCT Application No. PCT/JP2011/057548 (and English translation).

International Search Report dated Jul. 26, 2011 of PCT Application No. PCT/JP2011/057548.

* cited by examiner

Fig. 1

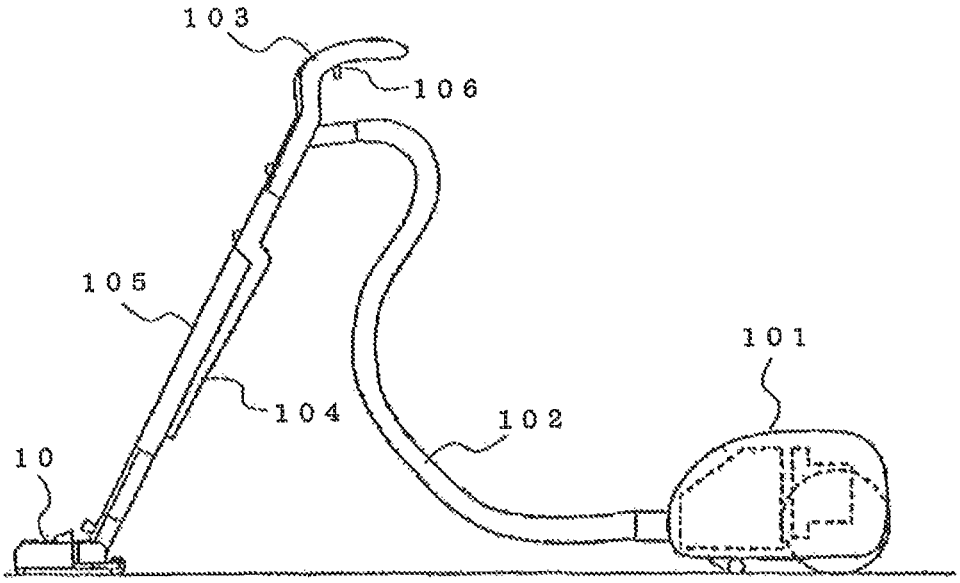


Fig. 2

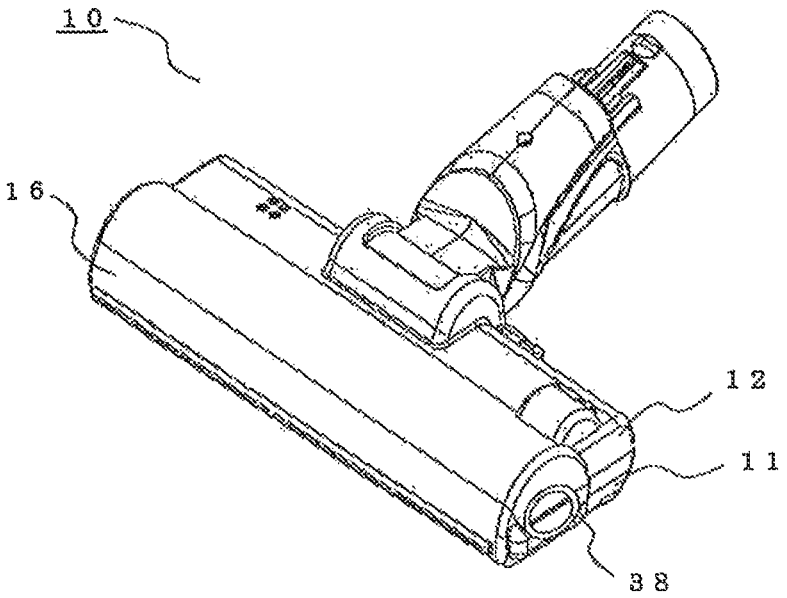


Fig. 3

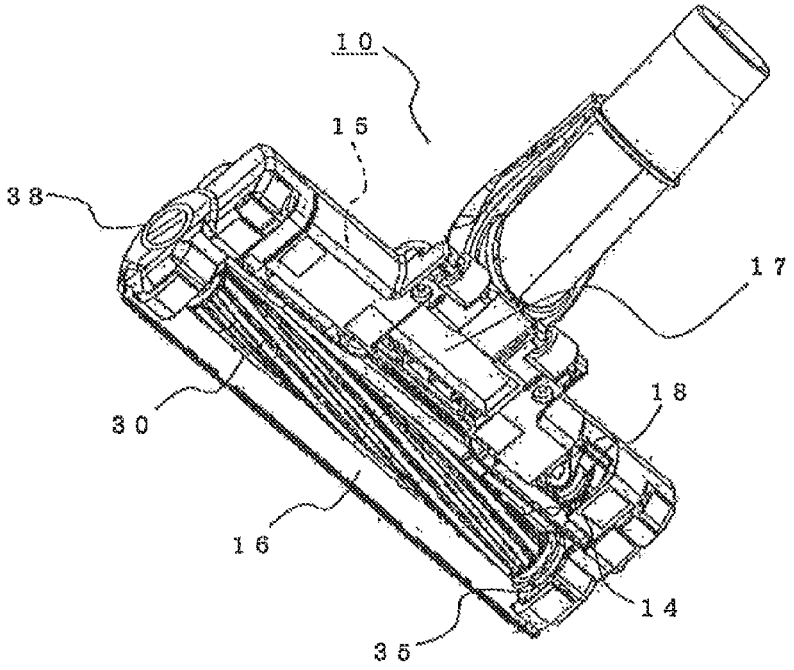


Fig. 4

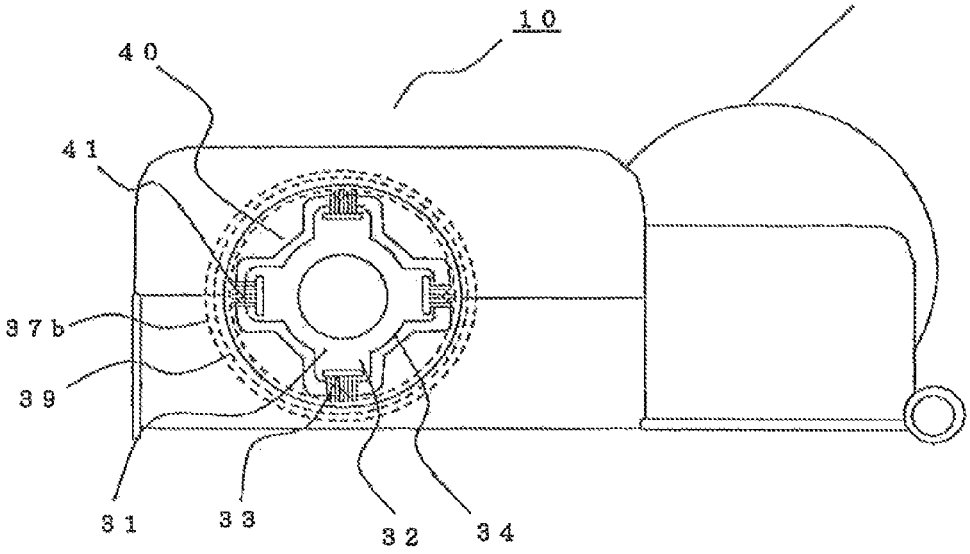


Fig. 5

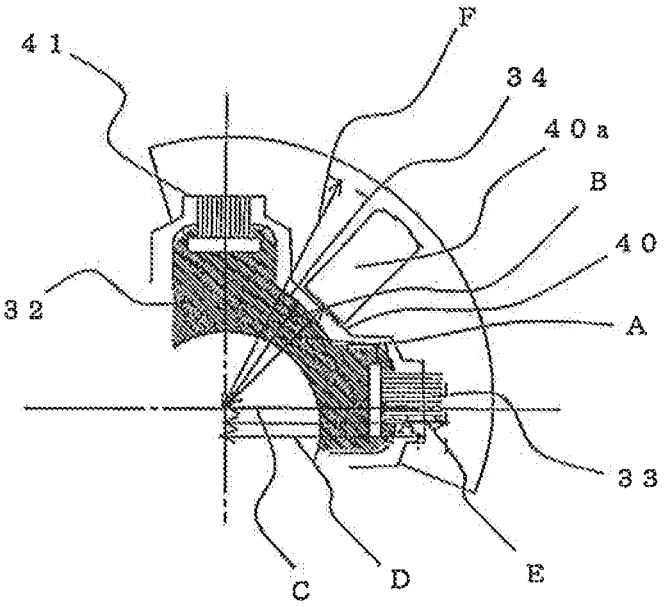


Fig. 6

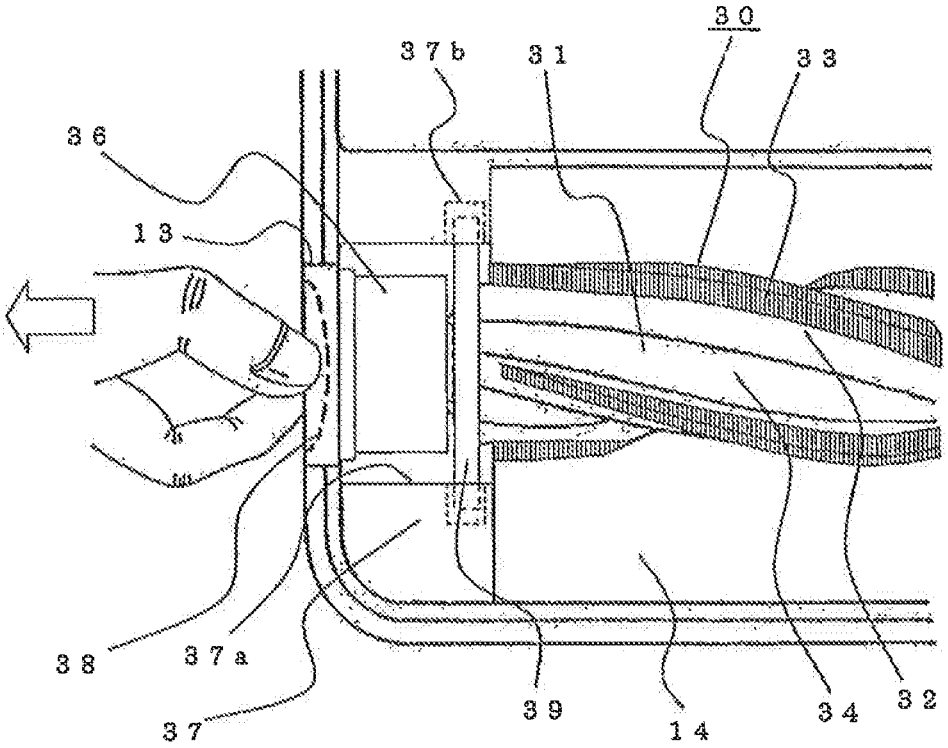


Fig. 7

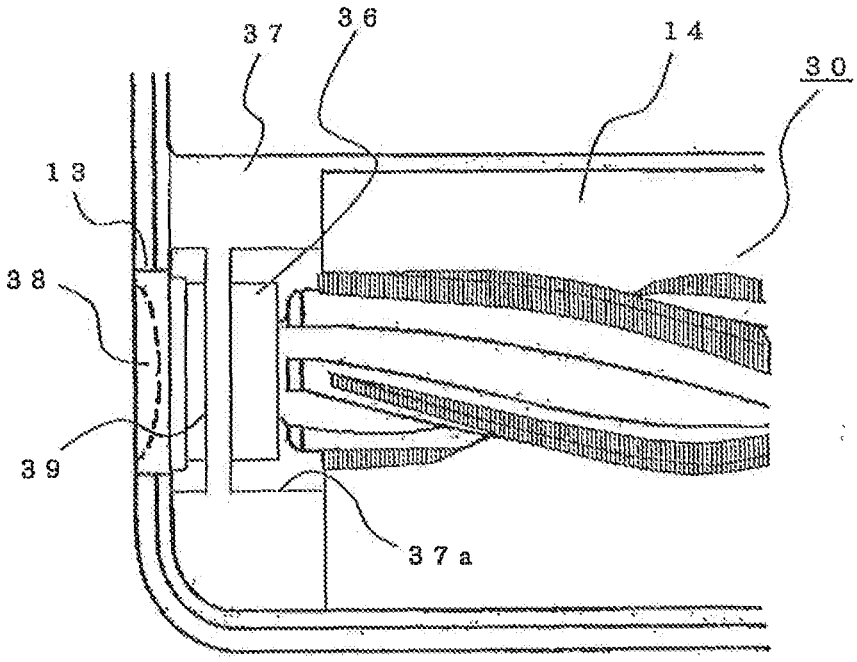


Fig. 8

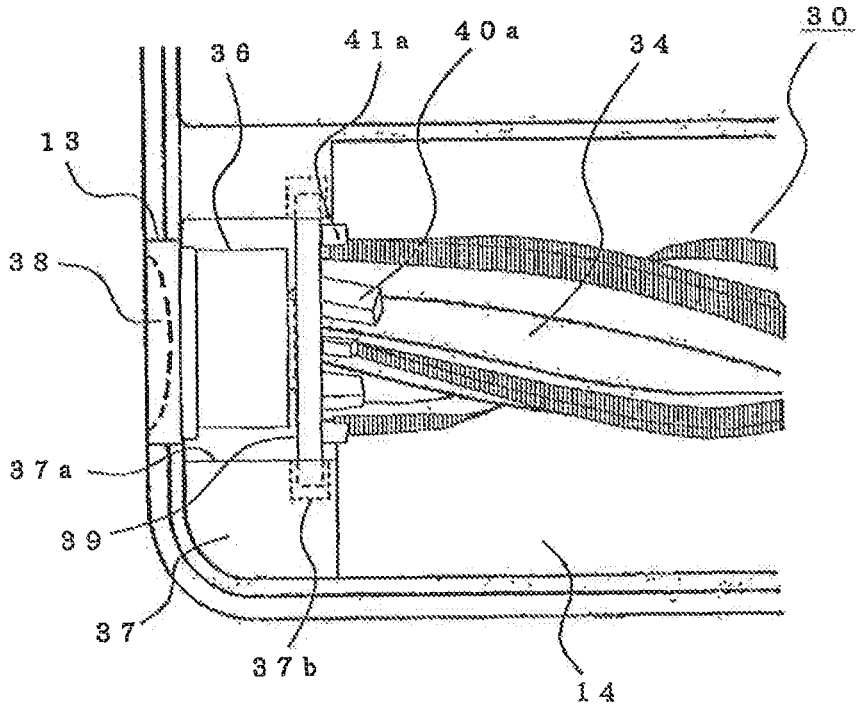


Fig. 9

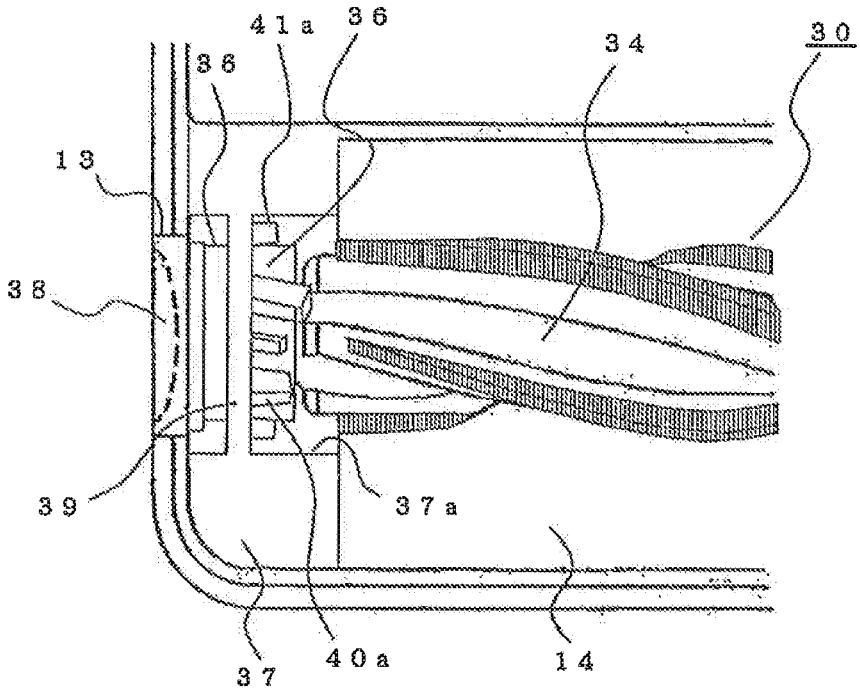
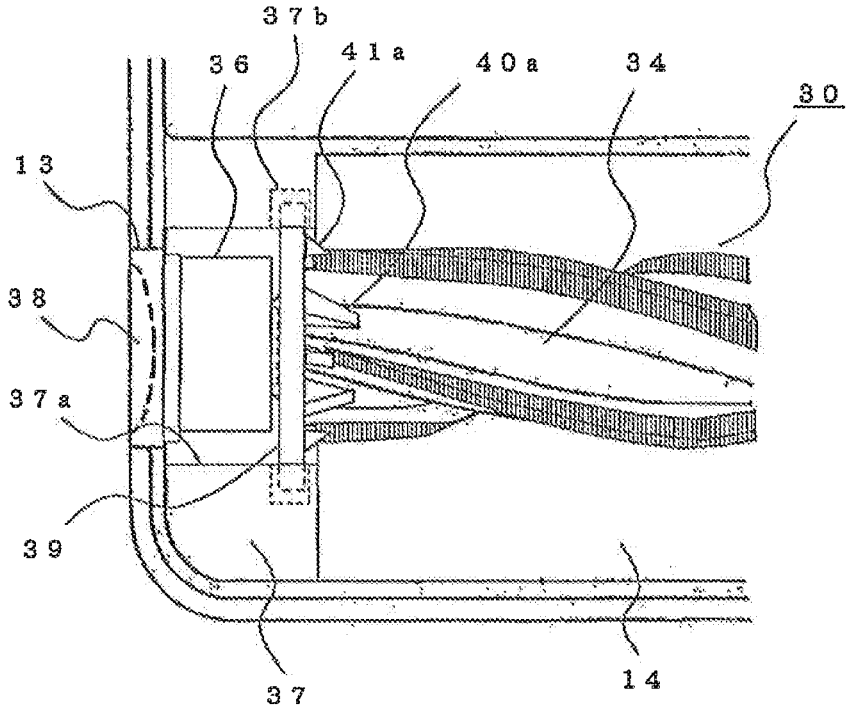

41a
36
36
34
30
13
38
39
37a
37
40a
14

Fig. 10


37b
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41a
40a
34
30
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37a
39
37
14

Fig. 11

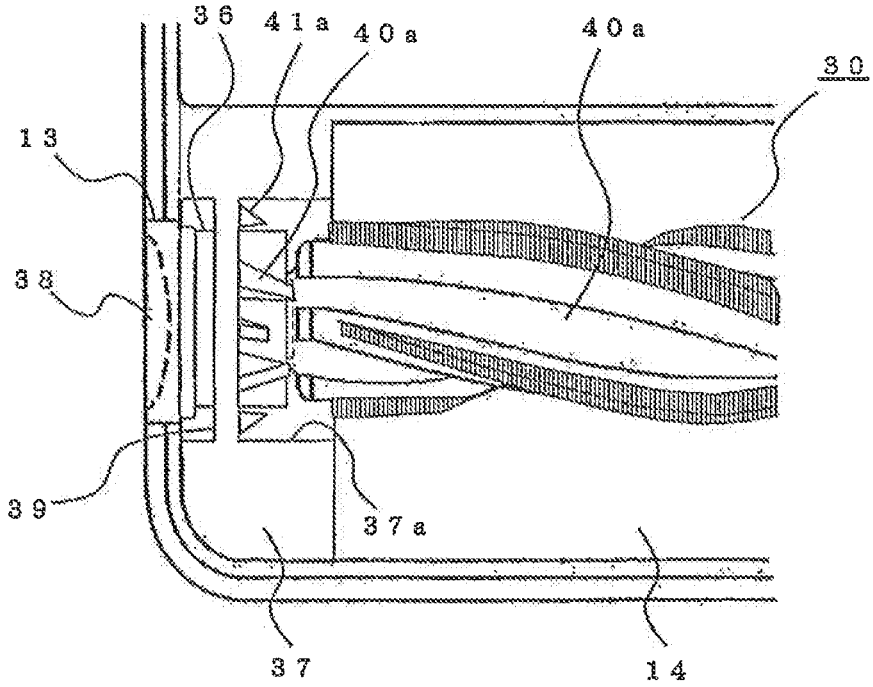


Fig. 12

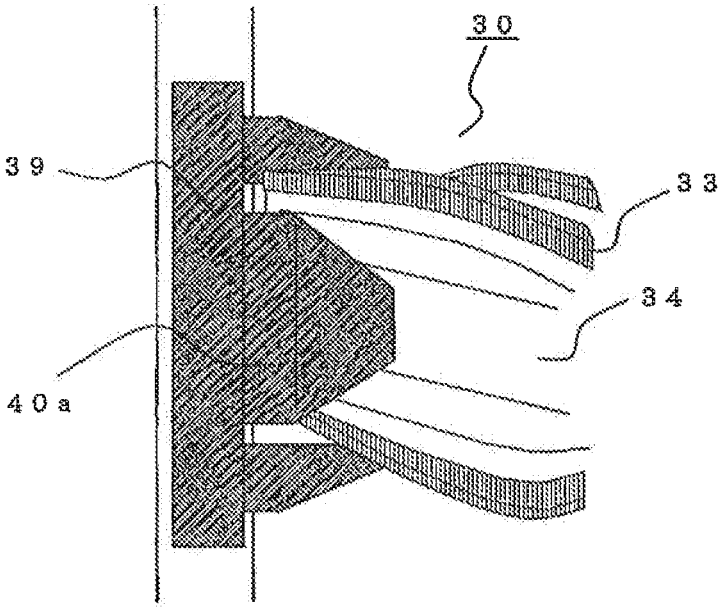
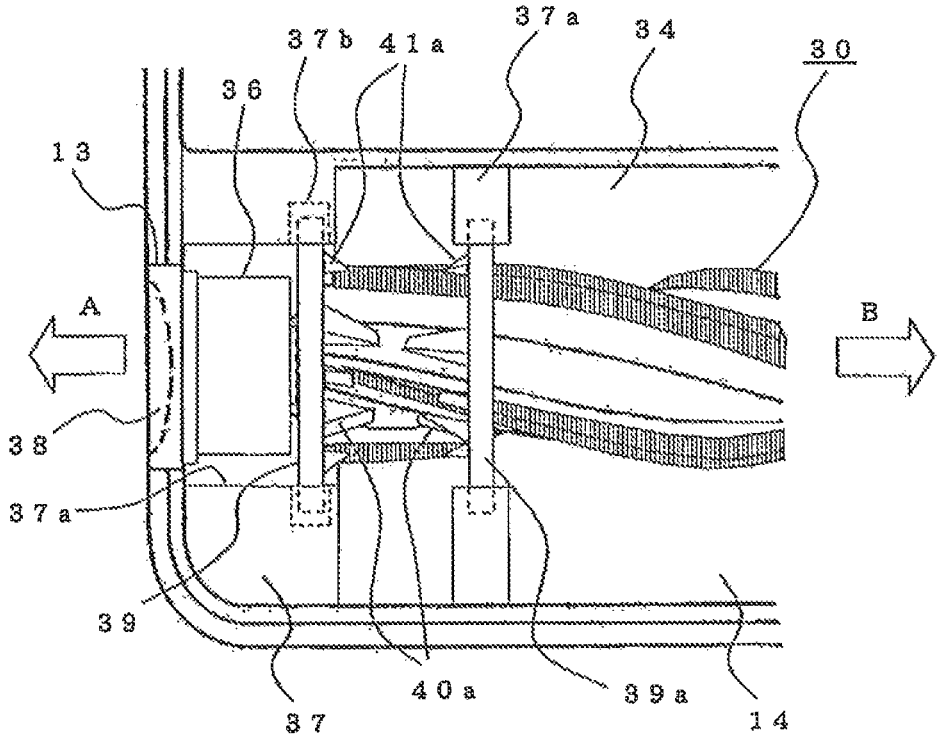


Fig. 13



SUCTION TOOL FOR VACUUM CLEANER

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a U.S. national stage application of PCT/JP2011/057548 filed on Mar. 28, 2011, and claims priority to, and incorporates by reference, Japanese Patent Application No. 2010-081593 filed on Mar. 31, 2010.

TECHNICAL FIELD

The present invention relates to a vacuum cleaner including a suction tool in which a rotating brush is provided, and more particularly to a vacuum cleaner in which dust or the like adhering to the rotating brush can be removed.

BACKGROUND ART

A rotating brush is mounted to a suction tool for a vacuum cleaner, and the rotating brush rotates to scrape up dust on a surface to be cleaned rearward to be sucked. If hair or thread is entangled around the rotating brush, the rotating brush does not function.

To solve such a problem, a vacuum cleaner has been proposed in which a rotating brush is first removed from a suction tool, and ring-shaped dust removing means provided on an outer periphery of the rotating brush is slid in an axial direction (longitudinal direction) of the rotating brush, then a guide of the dust removing means is guided in a spiral groove in a hollow base and slid in the axial direction (longitudinal direction) of the rotating brush, and thus a cutter blade provided in the dust removing means is spirally moved in contact with the groove in the axial direction (longitudinal direction) of the rotating brush to remove thread-like dust (for example, see Patent Literature 1).

A vacuum cleaner also has been proposed in which a rotating brush removable by axial movement is provided in a suction tool, dust removing means is provided in a rotating brush passing portion in a bulkhead that partitions the suction tool, the rotating brush is pulled out, and thus the dust removing means rubs against a brush portion to scrape off thread, hair, or lint entangled around the brush portion (for example, see Patent Literature 2).

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Patent Laid-Open No. 2008-259718 (page 7, FIG. 10)

Patent Literature 2: Japanese Patent Laid-Open No. 62-217930 (page 2, FIG. 5)

SUMMARY OF INVENTION

Technical Problem

For the suction tool for the vacuum cleaner described in Patent Literature 1, the rotating brush is removed to remove dust, and thus when the dust removing means is slid, the dust may be spread or directly touched by hand, which is not sanitary. Also, the cutter blade provided in the dust removing means may be touched, which is not safe.

For the suction tool for the vacuum cleaner described in Patent Literature 2, the dust removing means is brush bristles, and bent in a pull-out direction in removal. Thus, the dust flows out of the suction tool, or the rotating brush is pulled in an unstable manner to increase a pull-out force.

The present invention is made to solve the problem as described above, and has an object to provide a suction tool for a vacuum cleaner that can easily remove dust entangled around a rotating brush with a small force in a sanitary manner with clean hands without spreading dust.

Solution to Problem

A suction tool for a vacuum cleaner of the invention comprises a rotating brush having a cleaning body held via a cleaning body holding portion on a cylindrical base, a suction chamber having an opening in a lower part, and rotatably housing the rotating brush, driving means for rotationally driving the rotating brush, and dust removing means for removing dust adhering to the rotating brush. The dust removing means includes a first remover that is guided in an axial direction of the rotating brush within a gap and a second remover that comes into contact with a tip of the cleaning body. The dust removing means has substantially the same shape as a cross-sectional shape of a gap between cleaning bodies or between cleaning body holding portions of the rotating brush.

Advantageous Effects of Invention

According to the present invention, with the first remover and the second remover of the dust removing means, dust entangled around the rotating brush can be reliably removed in a sanitary manner with clean hands without spreading dust. Also, the first remover is guided in the axial direction of the rotating brush within a gap, and thus dust can be removed.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic side view showing an entire configuration of a vacuum cleaner in a first embodiment according to the present invention.

FIG. **2** is a perspective view showing a suction tool for the vacuum cleaner in the first embodiment seen from obliquely upward.

FIG. **3** is a perspective view showing the suction tool in FIG. **2** seen from obliquely downward.

FIG. **4** is a schematic sectional view showing the suction tool for the vacuum cleaner in the first embodiment.

FIG. **5** is an enlarged sectional view showing dust removing means and therearound in FIG. **4**.

FIG. **6** is an enlarged plan view showing the dust removing means and therearound provided in the suction tool in FIG. **3**.

FIG. **7** is a plan view showing another example in the first embodiment.

FIG. **8** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a second embodiment according to the present invention.

FIG. **9** is a plan view showing another example in the second embodiment.

FIG. **10** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a third embodiment according to the present invention.

FIG. **11** is a plan view showing another example in the third embodiment.

FIG. **12** is an enlarged plan view showing another example in a fourth embodiment.

FIG. **13** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a fifth embodiment according to the present invention.

DESCRIPTION OF EMBODIMENTS

First Embodiment

Without Remover Protrusion

FIG. **1** is a schematic side view showing an entire configuration of a vacuum cleaner in a first embodiment according to the present invention.

The vacuum cleaner includes a cleaner body **101** including an electric air blower, a control circuit, a dust collecting filter, and the like, a hose **102** having one end removably connected to a suction port of the cleaner body **101**, a handle portion **103** having a switch operation portion and provided at the other can of the hose **102**, an attachment body portion **104** such as a crevice nozzle provided in a branching manner at a tip of the handle portion **103**, an extension pipe **105** having one end removably connected to the other branch connection port of the handle portion **103** via an on-off valve, and a suction tool **10** to which the other end of the extension pipe **105** is removably connected. A trigger **106** for removing the extension pipe **105** is provided in a lower part of the handle portion **103**.

The attachment body portion **104** does not need to be provided at the end of the handle portion **103**, and only an extension pipe **105** of a generally used type may be removably connected to the end. The extension pipe **105** may be of a telescopic type with a telescopic pipe, or a joint pipe type with a plurality of pipes joined.

FIG. **2** is a perspective view showing a suction tool for the vacuum cleaner in the first embodiment seen from obliquely upward. FIG. **3** is a perspective view showing the suction tool in FIG. **2** seen from obliquely downward. FIG. **4** is a schematic sectional view showing the suction tool for the vacuum cleaner in the first embodiment, FIG. **5** is an enlarged sectional view showing dust removing means and therearound in FIG. **4**, FIG. **6** is an enlarged plan view showing the dust removing means and therearound provided in the suction tool in FIG. **3**.

The suction tool **10** has an appearance formed by a combination of a lower case **11** and an upper case **12**, and includes a suction chamber **14** having a horizontally long air duct. The suction chamber **14** rotatably houses a rotating brush **30**. The rotating brush **30** has one end rotatably supported by a bearing **35** and the other end rotatably supported by a rotating brush holding portion **36**, and is rotationally driven by a motor (or a turbine) that is driving means provided in the suction tool **10**. The motor is provided in a region **15** in FIG. **3**. A drive force of the motor is transferred, for example, via a belt to the rotating brush **30** to rotate the rotating brush **30** in a predetermined direction. An opening of the suction chamber **14** is provided in a bottom of the suction tool **10**, and a buffer portion **16** made of a soft material (for example, elastomer or vinyl chloride) that is relatively easily deformed is formed in a lower part of a front surface side of the suction tool **10**. A suction port **17** connected to the extension pipe **105** in FIG. **1** is provided in a rear surface side of the suction tool **10**. The suction port **17** communicates with the suction chamber **14**.

A wheel **18** supported by a support member (not shown) is provided on a bottom on a side of the suction port **17** in the suction tool **10**. The support member is pivotably mounted to the suction tool **10** so that the wheel **18** protrudes toward a floor surface side when the suction tool **10** is raised from the floor surface, and retracts inside the suction tool **10** when the suction tool **10** is placed on the floor. The suction tool **10** includes a switch (not shown) that is turned on when the wheel **18** is retracted, and the switch is turned on to bring the cleaner body **101** (see FIG. **1**) into a drivable state.

The rotating brush **30** includes a cylindrical base **31**, four integrally-molded cleaning body holding portions **32** protruding from an outer peripheral surface of the cylindrical base **31**, and spirally twisted in an axial direction so as to substantially cover the entire circumference of the cylindrical base **31**, and cleaning bodies **33** held by the cleaning body holding portions **32** and protruding from tips thereof. A spiral trough **34** is formed between the cleaning body holding portions **32**. The cleaning body holding portion **32** may be provided inside the cylindrical base **31** so that the cylindrical base **31** has a circular section externally (not shown). With such a configuration, the cleaning bodies **33** protrude from an outer peripheral surface of the cylindrical base **31**. As the cleaning body **33**, fibrous brush bristles or a blade made of a soft material may be used. The cleaning body **33** may be brush bristles with a combination thereof. Cleaning body holding portions **32** integrally molded on the outer peripheral surface of the cylindrical base **31** may be linearly formed in the axial direction. The number of the cleaning body holding portions is not limited to four, but at least two cleaning body holding portions may be provided.

A brush removing grip **38** is provided at one end of the rotating brush **30**, one end of the brush removing grip **38** is connected to the cylindrical base **31** by a shaft (not shown), and a rotating portion (not shown) including a bearing (not shown) therein rotatably holds the cylindrical base **31**. A knob **38***b* that can be held by fingers is formed in a straight line on an opposite side surface.

An opening **13** is provided in a side wall on a side of the rotating brush holding portion **36** among side walls formed by the combination of the lower case **11** and the upper case **12** of the suction tool **10**. The brush removing grip **38** is inserted into the opening **13**, and the knob **38***b* is held by the side wall in which the opening **13** is formed. On the side wall side with the opening **13**, a bulkhead **37** is provided as shown in FIG. **6**. The rotating brush holding portion **36** as a through hole around an axis of the rotating brush **30** is provided in the bulkhead **37**. A groove **37***b* is provided in an inner peripheral surface of the bulkhead **37** on a side of the suction chamber **14** of the rotating brush holding portion **36**. The rotating portion (not shown) of the brush removing grip **38** is placed in the rotating brush holding portion **36**, and a peripheral edge of dust removing means **39** is rotatably fitted in the groove **37***b*. When the knob **38***b* is pulled forward, the rotating portion **38***b* of the brush removing grip **38** is pulled out of the opening **13**, and then the rotatably supported rotating brush **30** is pulled out.

As shown in FIG. **4**, the dust removing means **39** has, for example, a circular outer shape, and an outer diameter thereof is smaller than a diameter of a bottom surface of the groove **37***a* in the bulkhead **37**. The dust removing means **39** has a substantially cross-shaped hole around an axis of the rotating brush **30**. In the hole, a protruding first remover **40** having substantially the same shape as the trough **34** provided between the cleaning body holding portions **32** of the cylindrical base **31**, and a recessed second remover **41** having substantially the same shape as the cleaning body holding portion **32** are provided. The first remover **40** protrudes toward the center correspondingly to the trough **34**. Now, with reference to FIG. **5**, the shape of the hole in the dust removing means **39** will be described using a distance from the center of rotation axis of the rotating brush **30**. A distance A between a

lower surface of the first remover **40** and the rotation axis of the rotating brush **30** is larger than a radius of the trough **34** of the cylindrical base **31**, and smaller than a distance C between the cleaning body holding portion **32** and the rotation axis of the rotating brush **30**. Also, a distance D between a lower surface of the second remover **41** and the rotation axis of the rotating brush **30** is smaller than a distance between a tip of the cleaning body **33** and the rotation axis of the rotating brush **30** so as to be in contact with the cleaning body **33** of the brush bristles. Specifically, the rotating brush **30** is sized to pass through the substantially cross-shaped hole formed in the dust removing means **39**. The second remover **41** has a triangular protrusion seen in the axial direction. This is provided for scraping off dust or the like adhering to the cleaning body **33**.

Next, an operation of the suction tool **10** will be described.

When the switch operation portion provided in the handle portion **103** is operated to drive the electric air blower in the cleaner body **101**, dust or the like on a floor surface is sucked with air into the suction chamber **14** of the suction tool **10**, and sucked from the suction port **17** in the suction tool **10** through the extension pipe **105** and the hose **102** into the cleaner body **101** (see FIG. **1**). At this time, the rotating brush **30** rotates, and the dust removing means **39** also rotates with the rotating brush **30**. Dust or the like scraped off by the rotation of the rotating brush **30** is also sucked. When the dust or the like is scraped up by the rotation of the rotating brush **30**, lint, fibrous dust, hair, or the like is entangled and tightly twisted around the rotating brush **30**. In such a state, dust, lint, or the like may adhere to the tip of the cleaning body **33** in a clump and sometimes cannot be removed.

In such a case, after cleaning of the floor surface, the switch operation portion is used to turn off power, and the brush removing grip **38** is pulled out of the suction tool **10** in the axial direction of the rotating brush **30**. Then, the rotating brush holding portion **36** is pulled out of the opening **13**, and then the rotating brush **30** is pulled out. At this time, the first remover **40** of the dust removing means **39** scrapes off dust or the like twisted around and adhering to the rotating brush **30**, and the dust drops from the opening of the suction chamber **14** to the floor surface in the suction tool **10**. Simultaneously, the second remover **41** scrapes off a dump of dust or the like adhering to the cleaning body **33** in the suction tool **10**. When the switch operation portion is used to again turn on the power, the dust or the like scraped off in the suction tool **10** is sucked with air and sucked into the cleaner body **101**.

The dust removing operation may be performed without turning off the power. In this case, dust is sucked simultaneously with pulling of the rotating brush **30**, thereby preventing the dust or the like adhering to the rotating brush **30** from spreading outside the suction tool **10**. This is more sanitary.

As described above, according to the first embodiment, the first remover **40** of the dust removing means **39** can easily remove lint, hair, or the like entangled around the rotating brush **30** with clean hand. The shape of the first remover **40** allows the rotating brush **30** to be pulled out along the side surfaces of the cleaning body holding portion **32** and the cleaning body **33**, which serve as guides. Thus, the rotating brush **30** can be easily pulled out straight in a pull-out direction (axial direction of the rotating brush **30**), thereby reducing a pull-out force. If the power is turned on when the brush removing grip **38** is used to pull out the rotating brush **30**, the adhering dust does not flow out around the suction tool **10**, which is sanitary.

Similarly, the second remover **41** allows a clump of dust or the like adhering to the cleaning body **33** to be easily removed with clean hand. When the brush removing grip **38** is held to pull out the rotating brush **30**, the rotating brush **30** is rotated and pulled out by the spiral cleaning body holding portion **32**. Thus, when the cleaning body **33** passes through the dust removing means **39**, the cleaning body **33** comes into contact with the second remover **41** in a complicated manner, thereby more effectively removing dust.

In the first embodiment, the second remover **41** at least comes into contact with the cleaning body **33**, but an amount of overlap between the second remover **41** and the cleaning body **33** may be increased. With increasing amount of overlap between the bottom surface of the second remover **41** and the cleaning body **33**, the pull-out force is increased, but a force to scrape the adhering dust is increased.

In the first embodiment, it is described that the dust removing means **39** is rotatably mounted to the bulkhead **37**, but as shown in FIG. **7**, the dust removing means **39** may be formed integrally with the suction tool **10** so that the rotating brush **30** can be pulled out. With such a configuration, the dust removing means **39** does not rotate with the rotating brush **30** in operation of the cleaner body **101**, thereby preventing wear of a peripheral edge of the dust removing means **39** by rotation, and reducing the number of components. Also, the dust removing means **39** may be separately configured and fixed to the bulkhead **37**. In this case, the same advantage can be obtained, and a shape of a mold can be simplified although the number of components is increased.

Second Embodiment

Protrusion Type Remover

FIG. **8** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a second embodiment according to the present invention.

In the second embodiment, the first remover **40** of the dust removing means **39** in FIG. **4***a* is provided with a protrusion **40***a*, and the second remover **41** is provided with a protrusion **41***a*. The protrusion **40***a* of the first remover **40** is placed correspondingly to the trough **34** of the rotating brush **30**, and extends in an axial direction of the rotating brush **30**. The protrusion **40***a* has a tetragonal planar shape. The protrusion **41***a* of the second remover **41** is placed correspondingly to the cleaning body **33** of the rotating brush **30**, and extends in the axial direction of the rotating brush **30**. The protrusion **41***a* has a planar shape having substantially the same width at a root and a tip, and has a tetragonal section.

In the second embodiment, the rotating brush **30** is pulled out, and thus the first remover **40** can easily remove lint, hair, or the like entangled around the rotating brush **30** with clean hand. The protrusion **40***a* of the first remover **40** allows adhering dust to be removed on a more inner side of the suction tool **10**, thereby preventing the adhering dust from flowing out around the suction tool **10**. The shape of the protrusion **40***a* allows the rotating brush **30** to be pulled out along a side surface (trough **34**) of a cleaning body holding portion **32**, which serves as a guide. Thus, the rotating brush **30** can be more easily pulled out straight in a pull-out direction (axial direction of the rotating brush **30**) than in the case without the protrusion, thereby reducing a pull-out force.

Similarly, the second remover **41** allows a clump of dust or the like adhering to the cleaning body **33** to be easily removed with clean hand. In the first embodiment, the amount of overlap between the bottom surface of the second remover **41** and the cleaning body **33** is increased in order to increase a scraping force of the second remover **41**, while in the second

embodiment, the protrusion **41***a* of the second remover **41** can scrape the adhering dust. Thus, a bottom surface of the protrusion **41***a* is sized to at least come into contact with the cleaning body **33**, thereby increasing dust removing performance with a small pull-out force.

As shown in FIG. **8**, the dust removing means **39** is rotatably provided in the groove **37***b* in the bulkhead **37**, and thus the protrusion **40***a* of the first remover **40** is configured to easily fit in the trough **34** in the axial direction of the rotating brush **30**, and the protrusion **41***a* of the second remover **41** is aligned with the cleaning body **33**. Thus, when a dust removing operation of the rotating brush **30** is started, the rotating brush **30** can be pulled out without being caught by the dust removing means **39**.

In the second embodiment, it is described that the dust removing means **39** is rotatably mounted to the bulkhead **37**, but as shown in FIG. **9**, the dust removing means **39** may be formed integrally with the suction tool **10** so that the rotating brush **30** can be pulled out. With such a configuration, the dust removing means **39** does not rotate with the rotating brush **30** in operation of the cleaner body **101**, thereby preventing wear of a peripheral edge of the dust removing means **39** by rotation, and reducing the number of components. Also, the dust removing means **39** may be separately configured and fixed to the bulkhead **37**. In this case, the same advantage can be obtained, and a shape of a mold can be simplified although the number of components is increased.

Third Embodiment

Inclined Protrusion Type Remover

FIG. **10** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a third embodiment according to the present invention.

In the third embodiment, the first remover **40** of the dust removing means **39** in FIG. **6** is provided with a protrusion **40***a*, and the second remover **41** is provided with a protrusion **41***a*. The protrusion **40***a* of the first remover **40** is placed correspondingly to the trough **34** of the rotating brush **30**, has a side surface shape with a flat surface on a side of the trough **34** of the rotating brush **30** so as to substantially come into contact with the trough gap **34** and a triangular shape inclined downward from a root toward a tip. A distance F between a root of the first remover **40**, that is, a root of the protrusion **40***a* and a rotation axis of the rotating brush **30** in FIG. **5** is larger than a distance **1**) between a lower surface of the second remover **41** and the rotation axis of the rotating brush **30**. The protrusion **41***a* of the second remover **41** is placed correspondingly to the cleaning body **33** of the rotating brush **30**, has a planar shape having substantially the same width at a root and a tip, and has a side surface shape with a flat surface on a side of the cleaning body **33** of the rotating brush **30** and a triangular shape inclined downward from the root toward the tip.

In the third embodiment, the first remover **40** can easily remove lint, hair, or the like entangled around the rotating brush **30** with clean hand. Since the protrusion **40***a* of the first remover **40** has the inclined protrusion shape (triangular shape), the twisted dust slides along the protrusion **40***a* to increase a twisting diameter (distance F) thereof, which is larger than the distance D between the lower surface of the second remover **41** of the dust removing means **39** and the rotation axis of the rotating brush **30**. This can prevent the twisted dust from resisting passage of the cleaning body **33** through the dust removing means **39**, and eliminates the need to increase a pull-out force.

Similarly, the second remover **41** allows a clump of dust or the like adhering to the cleaning body **33** to be easily removed with clean hand. Since the protrusion **41***a* of the second remover **41** has the inclined protrusion shape (triangular shape), the adhering dust can be removed on a more inner side of the suction tool **10**, thereby preventing the dust from flowing out around the suction tool **10**. Further, the protrusion **41***a* having the triangular side surface can reduce resistance against the cleaning body **33**, thereby reducing the pull-out force.

As shown in FIG. **10**, the dust removing means **39** is rotatably provided in the groove **37***b* in the bulkhead **37**, and thus the protrusion **40***a* of the first remover **40** is configured to easily fit in the trough **34** in the axial direction of the rotating brush **30**, and the protrusion **41**.*a* of the second remover **41** is aligned with the cleaning body **33**. Thus, when a dust removing operation of the rotating brush **30** is started, the rotating brush **30** can be pulled out without being caught by the dust removing means **39**.

A height of the root of the protrusion **41***a* of the second remover **41** is smaller than a height of the root of the protrusion **40***a* of the first remover **40**. Thus, when the rotating brush **30** is pulled out, the twisted dust is not pulled to increase the diameter, or the cleaning body **33**, the twisted dust, and the protrusion **41***a* do not increase the resistance to increase the pull-out force, thereby reducing the pull-out force.

In the third embodiment, it is described that the dust removing means **39** is rotatably mounted to the bulkhead **37**, but as shown in FIG. **11**, the dust removing means **39** may be formed integrally with the suction tool **10** so that the rotating brush **30** can be pulled out. With such a configuration, the dust removing means **39** does not rotate with the rotating brush **30** in operation of the cleaner body **101**, thereby preventing wear of a peripheral edge of the dust removing means **39** by rotation, and reducing the number of components. Also, the dust removing means **39** may be separately configured and fixed to the bulkhead **37**. In this case, the same advantage can be obtained, and a shape of a mold can be simplified although the number of components is increased.

Fourth Embodiment

Inclined Protrusion Conical Type Remover

FIG. **12** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a fourth embodiment according to the present invention.

In the forth embodiment, as shown in FIG. **12**, a protrusion **40***a* of the first remover **40** is placed correspondingly to the trough **34** of the rotating brush **30**, has a surface in contact with the rotating brush **30** with a certain space from a surface forming from the trough **34** to the cleaning body holding portion **32** of the rotating brush **30**, and has a side surface shape vertically protruding in an axial direction of the rotating brush **30** from a root toward a tip and then inclined downward in a triangular shape, and an outer peripheral surface of four protrusions **40***a* has a conical shape around the rotation axis. A distance F between a root of the first remover **40** and the rotation axis of the rotating brush **30** is larger than a distance D between a lower surface of the second remover **41** and the rotation axis of the rotating brush **30**. The protrusion **41***a* of the second remover **41** is placed correspondingly to the cleaning body **33** of the rotating brush **30**, has a planar shape having

substantially the same width at a root and a tip, and has a side surface shape with a flat surface on a side of the cleaning body **33** of the rotating brush **30** and a triangular shape inclined downward from the root toward the tip.

In the fourth embodiment, the first remover **40** can easily remove lint, hair, or the like entangled around the rotating brush **30** with clean hand. Since the protrusion **40***a* of the first remover **40** has the conical protrusion shape (triangular shape), the adhering dust can be removed on a more inner side of the suction tool **10**, and further, the twisted dust slides along the protrusion **40***a* to increase a twisting diameter thereof, which is larger than the distance D between the lower surface of the second remover **41** of the dust removing means **39** and the rotation axis of the rotating brush **30**. This can prevent the twisted dust from resisting passage of the cleaning body **33** through the dust removing means **39**, and eliminates the need to increase a pull-out force. Also, since the protrusion **40***a* vertically protrudes from the root, the twisted dust can be held inside the suction tool **10**, thereby preventing the removed dust from flowing outside, and allowing the removed dust to be easily sucked into the body.

Similarly, the second remover **41** allows a clump of dust or the like adhering to the cleaning body **33** to be easily removed with clean hand. Since the protrusion **41***a* of the second remover **41** has the inclined protrusion shape (triangular shape), the adhering dust can be removed on a more inner side of the suction tool **10**, thereby preventing the dust from flowing out around the suction tool **10**. Further, the protrusion **41***a* having the triangular side surface can reduce resistance against the cleaning body **33**, thereby reducing the pull-out three.

The dust removing means **39** is rotatably provided in the groove **37***b* in the bulkhead **37**, and thus the protrusion **40***a* of the first remover **40** is configured to easily fit in the trough **34** in the axial direction of the rotating brush **30**, and the protrusion **41***a* of the second remover **41** is aligned with the cleaning body **33**. Thus, when a dust removing operation of the rotating brush **30** is started, the rotating brush **30** can be pulled out without being caught by the dust removing means **39**.

A height of the root of the protrusion **41***a* of the second remover **41** is smaller than a height of the root of the protrusion **40***a* of the first remover **40**. Thus, when the rotating brush **30** is pulled out, the twisted dust is not pulled to increase the diameter, or the cleaning body **33**, the twisted dust, and the protrusion **41***a* do not increase the resistance to increase the pull-out force, thereby reducing the pull-out force.

In the fourth embodiment, it is described that the dust removing means **39** is rotatably mounted to the bulkhead **37**, but as shown in FIG. **11**, the dust removing means **39** may be formed integrally with the suction tool **10** so that the rotating brush **30** can be pulled out. With such a configuration, the dust removing means **39** does not rotate with the rotating brush **30** in operation of the cleaner body **101**, thereby preventing wear of a peripheral edge of the dust removing means **39** by rotation, and reducing the number of components. Also, the dust removing means **39** may be separately configured and fixed to the bulkhead **37**. In this case, the same advantage can be obtained, and a shape of a mold can be simplified although the number of components is increased.

Fifth Embodiment

FIG. **13** is an enlarged plan view showing dust removing means and therearound of a rotating brush of a vacuum cleaner in a fifth embodiment according to the present invention.

In the fourth embodiment, a bulkhead **37***a* and dust removing means **39***a* are added to the third embodiment in FIG. **9**. As shown in FIG. **11**, the bulkhead **37***a* having a through hole is provided in the suction chamber **14**, the dust removing means **39***a* is mounted to the bulkhead **37***a*, protrusions **40***a* of first removers **40** of dust removing means **39** and **39***a* face each other, and protrusions **41***a* of second removers **41** face each other.

In the fourth embodiment, when the rotating brush **30** is pulled out in a direction of arrow A, the dust removing means **39** removes adhering dust, and when the rotating brush **30** is returned in a direction of arrow B, the dust removing means **39***a* removes adhering dust. This reciprocation can more reliably remove dust adhering to the rotating brush **30**. Since the adhering dust accumulates between the dust removing means **39** and the dust removing means **39***a*, the dust removed from the rotating brush **30** can be easily disposed of or sucked by the cleaner body **101**.

In the first to fifth embodiments described above, it is described that the dust removing means **39** is used in the rotating brush **30** including the four cleaning body holding portions **32** spirally wound in the axial direction around the outer peripheral surface of the cylindrical base **31**, but not limited to this. For example, the dust removing means may be used in a rotating brush **30** including a cleaning body **33** protruding from an outer peripheral surface of a cylindrical base **31**. In this case, a first remover of the dust removing means has substantially the same shape as a trough gap provided between cleaning bodies.

Also, it is described that the dust removing means **39** is applied to the rotating brush **30** including the four cleaning bodies **33** spirally wound in the axial direction of the cylindrical base **31**, but it goes without saying that the dust removing means **39** may be applied to a rotating brush including a cleaning body **33** provided linearly in the axial direction of the cylindrical base **31**.

INDUSTRIAL APPLICABILITY

The present invention described above with the embodiments can be widely used as a vacuum cleaner with easy and sanitary maintenance.

Reference Signs List

10 suction tool, 11 lower case, 12 upper case, 13 opening, 14 suction chamber, 16 buffer portion, 17 suction port, 18 wheel, 30 rotating brush, 31 cylindrical base, 32 cleaning body holding portion, 33 cleaning body, 34 trough, 35 bearing, 36 rotating brush holding portion, 37 bulkhead, 38 brush removing grip, 39 dust removing means, 40 first remover, 40a protrusion, 41 second remover, 41a protrusion, 101 cleaner body, 102 hose, 103 handle portion, 104 attachment body portion, 105 extension pipe

The invention claimed is:

1. A suction tool for a vacuum cleaner comprising:

a rotating brush having a cleaning body held via a cleaning body holding portion on a cylindrical base;

a suction chamber having an opening in a lower part, and rotatably housing the rotating brush;

a driving device for rotationally driving the rotating brush; and

a dust removing device for removing dust adhering to the rotating brush,

wherein the dust removing device includes a first remover that has substantially the same shape as a trough between cleaning bodies or between cleaning body holding portions of the rotating brush, and is guided in an axial direction of the rotating brush within the trough,

wherein the first remover includes a protrusion placed correspondingly to the trough,

wherein the protrusion of the first remover has a side surface shape with a flat surface on a side of the trough of the rotating brush so as to come into contact with the trough and a triangular shape inclined downward from a root toward a tip,

wherein the protrusion of the first remover extends from the root to the tip in the axial direction of the rotating brush.

2. The suction tool for a vacuum cleaner according to claim 1, wherein

the rotating brush includes a brush removing grip for pulling out and removing the rotating brush in the axial direction, and

the dust removing device removes dust adhering to the rotating brush using the first remover when the rotating brush is pulled out by the brush removing grip.

3. The suction tool for a vacuum cleaner according to claim 1, wherein the cleaning body holding portions of the rotating brush protrude from an outer peripheral surface of the cylindrical base.

4. The suction tool for a vacuum cleaner according to claim 3, wherein the protrusion of the first remover has a largest diameter at the root, has a decreasing width in the axial direction of the rotating brush, has a surface that faces the rotating brush and forms substantially the same shape as the trough with a certain space, and has a conical shape inclined toward the tip circumferentially of the rotation axis.

5. The suction tool for a vacuum cleaner according to claim 1, wherein the dust removing device includes a second remover that at least comes into contact with tips of the cleaning bodies of the rotating brush.

6. The suction tool for a vacuum cleaner according to claim 5, wherein a distance between the second remover and a rotation axis of the rotating brush is larger than a distance between the cleaning body holding portion and the rotation axis of the rotating brush.

7. The suction tool for a vacuum cleaner according to claim 5, wherein a distance between an upper surface of the root of a protrusion of the first remover and the rotation axis of the rotating brush is larger than a distance between the second remover and the rotation axis of the rotating brush.

8. The suction tool for a vacuum cleaner according to claim 7, wherein the second remover includes a protrusion placed correspondingly to the cleaning body, and extending in the axial direction of the rotating brush.

9. The suction tool for a vacuum cleaner according to claim 8, wherein the protrusion of the second remover has an upper surface that faces a side of the cleaning body and is inclined downward from a root toward a tip.

10. The suction tool for a vacuum cleaner according to claim 9, wherein a height of the root of the protrusion of the second remover is smaller than a height of the root of the protrusion of the first remover.

11. The suction tool for a vacuum cleaner according to claim 10, wherein the protrusion of the first remover does not overlap the cylindrical base of the rotating brush in the axial direction.

12. The suction tool for a vacuum cleaner according to claim 1, wherein the dust removing device is rotatably held by a shaft provided in the suction tool, configured so that the rotating brush passes through substantially the center of the dust removing device, and rotated integrally with the rotating brush in operation.

13. The suction tool for a vacuum cleaner according to claim 1, wherein the protrusion of the first remover faces the cylindrical base of the rotating brush in the axial direction of the rotating brush, and fitted in the trough in a circumferential direction.

14. The suction tool for a vacuum cleaner according to claim 1, wherein the dust removing device is provided integrally with or fixed to the suction tool, has an opening through which the rotating brush passes through, and does not rotate in operation.

15. The suction tool for a vacuum cleaner according to claim 1, wherein the dust removing device can remove dust adhering to the rotating brush during operation.

16. The suction tool for a vacuum cleaner according to claim 1, wherein a plurality of dust removing devices are provided.

17. The suction tool for a vacuum cleaner according to claim 16, wherein the plurality of dust removing devices collect dust between adjacent dust removing devices.

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